REMARKS

Present Status of the Application

The Office Action rejected claims 4, 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Pevzner et al. (US 5,520,000) (hereinafter Pevzner) in view of Barclay et al. (US 5,505,232) (hereinafter Barclay). The Office Action rejected claim 9 under 35 U.S.C. 103(a) as being unpatentable over Pevzner in view of Barclay as applied to claims 4, 5 and 7 and further in view of White et al. (US 6,810,924) (hereinafter White). The Office Action objected claim 6, 8 and 10 as being depend upon a rejected base claim.

For at least the following reasons, Applicants respectfully submit claims 4-10 are in proper condition for allowance and reconsideration of this application is respectfully requested.

Discussion of the claim rejection under 35 USC 103(a)

The Office Action rejected claims 4, 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Pevzner in view of Barclay. The Office Action also rejected claim 9 under 35 U.S.C. 103(a) as being unpatentable over Pevzner in view of Barclay as applied to claims 4, 5 and 7 above and further in view of White et al.

Applicants respectfully traverse the rejections and submit that claims 4, 5, 7 and 9 and their dependent claims 6, 8 and 10 are patentable over Pevzner, Barclay and White, taken alone or in combination.

With respect to claim 4, independent claim 4 reads as:

> 4. A fuel filling apparatus, for filling a hydrogen gas into a fuel tank of an automobile that uses the hydrogen gas as a fuel, the fuel filling apparatus comprising a heat exchanger **using a liquid inert gas as a refrigerant** for cooling the hydrogen gas**, wherein the liquid inert gas does not mix with the hydrogen gas**.
> ... (Emphasis added)

Claim 5 also recites the similar features.

Pevzner (col. 4, lines 2-7) discloses, "A gaseous hydrogen outlet conduit 18 feeds gas to a lower portion of a gas/liquid mixer 20. A liquid hydrogen outlet conduit 22 feeds liquid hydrogen through a control valve 24 to an upper portion of gas/liquid mixer 20. A porous packing 25 enables gas entering, via conduit 18, into gas/liquid mixer 20 to percolate upwardly to an outlet conduit 26." Pevzner discloses that "**The liquid hydrogen is used as a refrigerant. The gaseous hydrogen and liquid hydrogen are mixed in the gas/liquid mixer 20**." However, in present invention, a **liquid inert gas is used as a refrigerant. The liquid inert gas and the gaseous hydrogen are not mixed.** The Pevzner fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claims 4 and 5.

Barclay (col. 2, lines 49-56 and col.3, lines 3-11) discloses, "The **natural gas** passes through a forward flow passageway 27 of the first heat exchanger/vaporizer 26 where it is **precooled** by a countercurrent flow of **relatively cooler pressurized liquefied natural gas** passing through countercurrent passageway 29. The **pressurized liquefied natural gas** in passageway 29 is simultaneously vaporized by **the relatively warmer natural gas** in

passageway 27. Natural gas passes through a forward flow passageway 37 of the second heat exchanger/vaporizer 36 where it is precooled by a countercurrent of **relatively cooler pressurized liquefied natural gas** flowing through countercurrent passageway 38 prior to entering the liquefier 50. The **pressurized liquefied natural gas** flowing through passageway 38 is simultaneously vaporized from **the relatively warmer flow of natural gas** in passageway 37 to produce compressed natural gas." Barclay discloses that "**The pressurized liquefied natural gas is used as a refrigerant**. The **natural gas is cooled by the pressurized liquefied natural gas**." However, in present invention, a **liquid inert gas is used as a refrigerant and the hydrogen gas is cooled by liquid inert gas such as liquefied nitrogen, liquefied argon, and ethylene glycol.** The boiling point of the refrigerants used in present invention is higher than that of the hydrogen gas. The hydrogen does not solidify and liquefy, and the hydrogen is easily controlled. Further, it is convenient to use the inert gas. The Barclay fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claims 4 and 5.

Therefore, claims 4 and 5 are patentable over Pevzner and Barclay, taken alone or in combination, and should be allowed.

With respect to claim 7, independent claim 7 recites:

> 7. A fuel filling apparatus, for filling a hydrogen gas into a fuel tank of an automobile that uses the hydrogen gas as a fuel, the fuel filling apparatus comprising:

> a flow modulating valve, for modulating a supply amount of a hydrogen gas; and
>
> a cooling means **using a liquid inert gas as a refrigerant**, for cooling the hydrogen gas passing through the flow modulating valve, **wherein the liquid inert gas does not mix with the hydrogen gas**.
>
> ... (Emphasis added)

Pevzner (col. 4, lines 2-7) discloses, "A gaseous hydrogen outlet conduit 18 feeds gas to a lower portion of a gas/liquid mixer 20. A liquid hydrogen outlet conduit 22 feeds liquid hydrogen through a control valve 24 to an upper portion of gas/liquid mixer 20. A porous packing 25 enables gas entering, via conduit 18, into gas/liquid mixer 20 to percolate upwardly to an outlet conduit 26." Pevzner discloses that "**The liquid hydrogen is used as a refrigerant. The gaseous hydrogen and liquid hydrogen are mixed in the gas/liquid mixer 20**." However, in present invention, a **liquid inert gas is used as a refrigerant. The liquid inert gas and the gaseous hydrogen are not mixed.** The Pevzner fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claim 7.

Barclay (col. 2, lines 49-56 and col.3, lines 3-11) discloses, "The **natural gas** passes through a forward flow passageway 27 of the first heat exchanger/vaporizer 26 where it is **precooled** by a countercurrent flow of **relatively cooler pressurized liquefied natural gas** passing through countercurrent passageway 29. The **pressurized liquefied natural gas** in passageway 29 is simultaneously vaporized by **the relatively warmer natural gas** in passageway 27. Natural gas passes through a forward flow passageway 37 of the second heat exchanger/vaporizer 36 where it is precooled by a countercurrent of **relatively cooler**

pressurized liquefied natural gas flowing through countercurrent passageway 38 prior to entering the liquefier 50. The **pressurized liquefied natural gas** flowing through passageway 38 is simultaneously vaporized from **the relatively warmer flow of natural gas** in passageway 37 to produce compressed natural gas." Barclay discloses that "**The pressurized liquefied natural gas is used as a refrigerant**. The **natural gas is cooled by the pressurized liquefied natural gas**." However, in present invention, a **liquid inert gas is used as a refrigerant and the hydrogen gas is cooled by liquid inert gas such as liquefied nitrogen, liquefied argon, and ethylene glycol.** The boiling point of the refrigerants used in present invention is higher than that of the hydrogen gas. The hydrogen does not solidify and liquefy, and the hydrogen is easily to be controlled. Further, the inert gas is easily to be used. The Barclay fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claim 7.

Therefore, claim 7 is patentable over Pevzner and Barclay, taken alone or in combination, and should be allowed.

With respect to claim 9, independent claim 9 recites:

> 9. A fuel filling method, for filling a hydrogen gas into a fuel tank of an automobile that uses the hydrogen gas as a fuel by using an fuel filling apparatus, wherein the fuel filling apparatus comprises a flow modulating valve for modulating a supply amount of the hydrogen gas and a cooling means **using a liquid inert gas as a refrigerant** for cooling the hydrogen gas**, wherein the liquid inert gas does not mix with the hydrogen gas,** and the fuel filling method comprising:

cooling the hydrogen gas passing through the flow modulating valve by using the cooling means; and

filling the cooled hydrogen gas into the fuel tank.

... (Emphasis added)

Pevzner (col. 4, lines 2-7) discloses, "A gaseous hydrogen outlet conduit 18 feeds gas to a lower portion of a gas/liquid mixer 20. A liquid hydrogen outlet conduit 22 feeds liquid hydrogen through a control valve 24 to an upper portion of gas/liquid mixer 20. A porous packing 25 enables gas entering, via conduit 18, into gas/liquid mixer 20 to percolate upwardly to an outlet conduit 26." Pevzner discloses that "**The liquid hydrogen is used as a refrigerant. The gaseous hydrogen and liquid hydrogen are mixed in the gas/liquid mixer 20**." However, in present invention, a **liquid inert gas is used as a refrigerant. The liquid inert gas and the gaseous hydrogen are not mixed.** The Pevzner fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claim 9.

Barclay (col. 2, lines 49-56 and col.3, lines 3-11) discloses, "The **natural gas** passes through a forward flow passageway 27 of the first heat exchanger/vaporizer 26 where it is **precooled** by a countercurrent flow of **relatively cooler pressurized liquefied natural gas** passing through countercurrent passageway 29. The **pressurized liquefied natural gas** in passageway 29 is simultaneously vaporized by **the relatively warmer natural gas** in passageway 27. Natural gas passes through a forward flow passageway 37 of the second heat exchanger/vaporizer 36 where it is precooled by a countercurrent of **relatively cooler pressurized liquefied natural gas** flowing through countercurrent passageway 38 prior to

entering the liquefier 50. The **pressurized liquefied natural gas** flowing through passageway 38 is simultaneously vaporized from **the relatively warmer flow of natural gas** in passageway 37 to produce compressed natural gas." Barclay discloses that "**The pressurized liquefied natural gas is used as a refrigerant**. The **natural gas is cooled by the pressurized liquefied natural gas**." However, in present invention, a **liquid inert gas is used as a refrigerant and the hydrogen gas is cooled by liquid inert gas such as liquefied nitrogen, liquefied argon, and ethylene glycol.** The boiling point of the refrigerants used in present invention is higher than that of the hydrogen gas. The hydrogen does not solidify and liquefy, and the hydrogen is easily to be controlled. Further, the inert gas is easily to be used. The Barclay fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claim 9.

White also fails to teach or suggest the limitation of "**using a liquid inert gas as a refrigerant, wherein the liquid inert gas does not mix with the hydrogen gas**." as required by the present invention, as set forth in claim 9.

Therefore, claim 9 is patentable over Pevzner, Barclay and White, taken alone or in combination, and should be allowed.

For at least the same reasons, dependent claims 6, 8 and 10 patently define over the cited prior art.

CONCLUSION

For at least the foregoing reasons, it is believed that all the pending claims 4-10 of the present application patently define over the prior art and are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,
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